

HISTOLOGICAL CHANGES IN THE GONADS
OF THE BLUEGILL,
LEPOMIS MACROCHIRUS RAFINESQUE,
AND OF THE LARGEMOUTH BASS,
HURO SALMOIDES (LACÉPÈDE),
ACCOMPANYING SEASON, AGE,
AND CONDITION

BY

MARIAN FRANCES JAMES

A.B., Illinois College, 1937
M.A., University of Illinois, 1939

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ZOOLOGY
IN THE GRADUATE SCHOOL OF THE
UNIVERSITY OF ILLINOIS, 1942

URBANA, ILLINOIS
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From March, 1941, to July, 1942, 742 bluegills, *Lepomis macrochirus* Rafinesque, and 218 largemouth bass, *Huro salmoides* (Lacépède) were collected by G. W. Bennett, of the Illinois Natural History Survey, at monthly intervals (with the exception of December, January, and February, 1941-1942) from Fork Lake, near Mount Zion, Illinois. During the spring of 1942, 153 bass from Ridge Lake, near Charleston, Illinois, and 22 bass from Lake Glendale, near Glendale, Illinois, were added to the Fork Lake bass collection.

The total length and weight of each fish were measured, and scales were taken for age determinations. The gonads were removed, weighed on a chainomatic balance, and fixed in Bouin's. After sectioning and staining with Heidenhain's iron alum haematoxylin, the tissues were examined.

Since a number of experiments on the general effects of the abundance of food on the largemouth bass and bluegill had already been carried out by the Natural History Survey, it was desired to compare the gonads of these specimens with those of normal fish. The tissues from a largemouth bass starvation experiment, a bluegill feeding experiment, and a largemouth bass feeding experiment were prepared for histological study.

This investigation reveals that there is a large seasonal variation in the gonads of the bluegill and the largemouth bass. They increase decidedly in weight previous to, and decrease during, the spawning period. Both the ovary and the testis form a greater percentage of the body weight in the older fish than in the younger mature ones.

The spawning of the largemouth bass at Fork Lake occurred during late April and May and that of the bluegill continued from June to late August. In March, the testes of the 1939 brood bluegills averaged 0.1 per cent of the body weight, whereas in May they increased to 1.0 per cent. The maximum size of the ovaries (1939 brood bluegills) averaged 8 per cent of the body weight. During the winter months the size of the ovaries was much less, being 1 per cent of the body weight.

The increase in weight of the ovary is due to increase in size of the eggs, brought about by addition of yolk to the eggs, and the decrease in size after spawning is immediately followed by resorption of any eggs in

the mature stage. The return of the ovary to mature size between fall and spring is correlated with the development of the immature eggs as they grow through stages of vacuolation and deposition of yolk material.

In March the lobules of the mature bluegill and bass testis are filled with cysts whose cells are dividing rapidly. At this time the size of the cysts is greater, and more mitotic stages are present. Consequently, the testes increase in size, and large quantities of sperm are found previous to spawning. The medulla of the testis is swollen and the ducts filled with sperm.

The bass spawn completely, and different individuals vary but slightly in the time of spawning. In the bluegill there seems to be a succession of partial extrusions during the entire summer.

The gonads increase in size as the temperature of the water rises and decrease in size before the average water temperature falls.

From the histological standpoint the gonads of the largemouth bass and those of the bluegill were the same in structure and underwent the same changes.

The bluegills spawned at the age of one year, but it took two years for the largemouth bass to become sexually mature. The larger fish of a year class became sexually mature earlier than the smaller ones. That immaturity is related to size is further evidenced by the fact that some of the smaller bluegills failed to mature and spawn during their second summer.

The gonads of the 1941 brood bass, obtained during April and May at Ridge Lake and Lake Glendale, showed the same histological condition as the 1941 brood bass from Fork Lake but the ovaries were more enlarged. There was much cytoplasmic vacuolation of the individual oocytes. However, no yolk granules were present, and many of the vacuolated oocytes were undergoing atresia. This indicated that the largemouth bass did not spawn in these lakes when one year old.

Comparative egg counts of the various oocyte stages for a number of specimens gave additional evidence confirming seasonal changes. The histological changes of the ovary and testis also coincided very closely with the change of the external appearance.

It is evident that in this case there is also a relation between the condition of the gonads and the condition of the fish. In all material studied, therefore, the condition of the animal is reflected in the histological condition of the gonad. In the experimental work the fish receiving diets higher than necessary for maintenance developed normal mature gonads whereas those on poorer diets were adversely affected. Similarly the larger, more rapidly growing fish taken from natural habitat at crucial

periods of development showed greater maturity than did the less well-nourished members of the same brood. After bass were starved for several months the ovaries showed much egg resorption and many empty spaces. In the testes the sperm and other spermatogenic cells had disintegrated and the degenerating sperm were scattered throughout the testis, which was composed largely of connective tissue.

VITA

Marian Frances James was born at Rochester, Illinois, on June 27, 1916, and attended an elementary school near Edinburg, Illinois. She graduated from the Edinburg Township High School in 1933. Her undergraduate education was obtained at Illinois College, Jacksonville, Illinois, where she received the Bachelor of Arts degree in 1937. During 1935-1936 and 1936-1937 she was an undergraduate assistant in biology. The following year, 1937-1938, she taught in the Jacksonville public school system. She received a scholarship from the Graduate School at the University of Illinois for 1938-1939 and obtained the Master of Arts degree in June, 1939. The academic year of 1939-1940 she was an assistant in zoology at the University of Illinois. She received a Fellowship in Zoology for 1940-1941 and the third-year Fellowship for 1941-1942. The summer of 1935 was spent in study at the Indiana University Biological Station, Winona Lake, Indiana. She spent the summer of 1939 in study at the University of Illinois and the summer of 1940 in marine study at the Marine Biological Laboratory, Woods Hole, Massachusetts. During the summer of 1941 she was an assistant in zoology at the University of Illinois, and the summer of 1942 she was a research assistant at the Illinois Natural History Survey.

She is a member of Phi Beta Kappa, Sigma Xi, Sigma Delta Epsilon, and Phi Sigma.

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